PATENT APPLICATION

TITLE:

Lighting Control Using Speech Recognition

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Related Applications

This Patent Application claims the benefit of priority to Provisional Application Serial Number 60/221,363 filed July 27, 2000, entitled "Lighting Control Using Speech Recognition," which is incorporated herein by reference.

Background of The Invention

1. Field of the Invention

The invention relates to systems and methods for the programming of lighting, in particular to voice programming of lighting.

2. Description of Related Art

Known technology combines multiple light-emitting diodes LEDs in one or more packages with a microprocessor. This combination is provided in US Patent 6,016,038 the entire disclosure of which is herein incorporated by reference. This type of technology gives an enormous opportunity for control possibilities. The combination of the network and a controller allows the controller to access and control each of the devices on the network. This can be used to synchronize and coordinate more than one light to produce pleasing effects. Examples of such effects include the movement of color within a room, or the shift of a rainbow across the room or even the effect of the passage of time through the simulation of a sunrise and sunset across multiple lights in a room.

Turning lights on and off and then controlling the lights typically requires human interfaces that incorporate the use of standard devices such as hand or finger-actuated switches or knobs. Touch plates, switches, knobs, dials, sliders, rockers, and all manner of mechanical interfaces to electrical signals provide for control and manipulation of signals, which are then mapped to lighting changes. For colored lights, additional dimensions of representation and control complicate this. These include modification of hue, saturation or brightness or even temporal and geometric changes. This can include the modification of the rate of change of an effect or the effect itself.

Summary of the Invention

In one embodiment, a simple control language based upon spoken words consisting of commands and values may be constructed and used to provide a common base for lighting and system control.

In another embodiment, a system for the control of color-based lighting through voice control may be presented. The system may be comprised of a transducer for taking in voice signals; a lighting system capable of controlling at least one lighting device wherein the lighting device is capable of producing multiple colors; and a computing device for converting the voice signals into signals that can be used by the lighting system to control said at least one lighting device.

In a further embodiment, a method for the control of color-based lighting may be presented. The method may comprise having a user speak a command in a syntax composed for use with a lighting system; translating the command into a signal to be used to control a lighting device, wherein the lighting device is capable of producing multiple colors, controlled by the lighting system; and using the signal to carry out an action on the lighting device, such that the action carried out corresponds to the command given.

Brief Description Of Drawings

FIG. 1 shows a block diagram of a voice controlled lighting system according to one embodiment of the invention.

FIG. 2 illustrates the lighting system of Fig. 1 coupled to a lighting network.

FIG. 3 illustrates a lighting device that can be used in voice controlled lighting systems according to embodiments of the present invention.

Detailed Description

As shown in FIG. 1, one embodiment of the invention comprises several elements including a transducer 3, such as a microphone, which converts the acoustics of voice from the user 1 into an electrical signal. This electrical signal is then digitized and input into a computing device for processing. Speech recognition module 5 (which may be implemented in software) is then used to recognize the speech input and provide language output corresponding to the spoken words. This input becomes a command

stream that is presented to a command interpreter 7 which then executes the command to the lighting control 9 and eventually the lights 11.

FIG. 2 illustrates one possible arrangement of the lights 11 in accordance with an embodiment of the present invention. The lights 11 may be part of a network where each light has a unique address. The lighting control signals communicated from the lighting control 9 may include addressed data such that each of the individual lights 11 responds to commands corresponding to its particular address. In an embodiment, the particular light 11 may be chosen through a verbal command and the lighting control 9 may communicate instructions to the intended light 11. In another embodiment, the lights may be arranged in groups or have group addresses. For example, if all of the lights 11 have a unique address, a set of unique addressed lights may be arranged in a group such that all of the lights in a group act as one. Several lights 11 may also be set to the same address to effectuate the grouping. One skilled in the art will appreciate that there are many methods for grouping lights 11 or other devices, so that the present invention is not limited to any particular method of grouping. Grouping the lights 11 can be useful in customizing the desired lighting effects. For example, several lights 11 may be grouped as a first address 20, and several lights may be grouped as a second address 22. The user may speak into a microphone 3, or other transducer, and direct the commands to the grouping in address 20. Upon identification and command language, the group of lights corresponding to address 20 may respond accordingly. The lights of address 20 may be lighting an archway for example while the lights of address 22 are lighting a wall of a building.

In one embodiment shown in FIG. 3, a light 11 may include a processor 300 wherein the processor can receive commands through a data port 310 and control, in response to the commands, at least one LED 302 as indicated in figure 3. In one embodiment, the processor may independently control multiple LEDs 302, 304, and 306. This may be useful where the control of color changing lighting is desired. For example, the three LEDs 302, 304, and 306 may be red, green and blue and the processor may be able to control the output of each LED such that the emitted color from the light 11 changes. It should be appreciated that the present invention is not limited to use with lights configured as shown in FIG. 3, as numerous other configurations are possible, including different numbers of LEDs or light sources other than LEDs.

If the speech is unintelligible or the command nonsensical, then the system can respond with an error message. This can take the form of an indicator including the lights themselves, a display, or, to keep the interface uniform, can be voice-generated output.

A number of speech recognition programs are available from a number of companies such as SpeechWorks, Dragon Systems, IBM and others. Some of these systems provide a modularity that allows developers to incorporate speech recognition in their platforms and systems. In an embodiment of the present invention, a standard microphone may be used to provide speech input to a computer-based system that takes that input, digitizes it and then uses a speech recognition component to provide commands. Because the grammar and syntax of the command set is known and the context is known, this winnows down the possibilities of interpreting the speech input a great deal. This then provides for a simpler interpretation process and allows the speech recognition module to deliver a compact 'language' for the Command Interpreter to execute.

In an embodiment, the command set provides for the concatenation of a few simple commands. The first is an attention getter for the system so that normal conversation doesn't result in unwanted interpretations. (Similar to when they say "Computer, <command>" on Star Trek.)

Commands can take the form of objects (e.g. a room, a specific light, a group of lights) and actions or values. These commands can be concatenated to form a full 'sentence' of description.

Examples:

<System call><object><value>

"Light Room redder" - results in incremental change in light output

"Light Room RGB 128 128 128" - results in light output with RGB values and default brightness.

"Light Desk warmer" – results in an incremental decrease in color temperature of a desk light.

All means for describing color can be used ranging from detailed technical means such as coordinates of the CIE diagram or Color Temperature values, to far more general 'warmer', 'redder', 'darker', 'lighter' values or turning on and off as well as commands to indicate duration and effects such as "Light Room Effect Rainbow." In an

embodiment, voice commands may be used to set a new effect. In an embodiment, the light may be set to a particular setting and that becomes a new default. Other examples of commands may include:

"Light Room Name Party" or "Light Room Name Romance" (depending on the desired mood)

Timing can also be set from such a construct: "Light Room Turn-on ten o'clock"

In an embodiment, the lighting effects may transition between addressed lights 11 or groups of lights 20 and 22. For example, the effect or value of "effect rainbow" may initiate a lighting program that starts a first light 11 and then moves to a second light 11. The first light 11 may cycle through the colors of the rainbow starting with the color blue and the second light 11 may also cycle through the same colors but the blue will be offset in time from the first light 11 such that it appears as though the light is moving through the room. One with ordinary skill in the art would appreciate that there are many lighting effects that can be generated on networked and non-networked lighting systems and the present invention is not limited in any way to a particular effect.

Color is visually represented in several ways including the CIE diagram and other diagrams such as hue wheels, or Munsell spaces or even Pantone colors. These visual representations can be used as a model for directing direction and change such as saying coordinates of a color, but a more natural way is to modify a color by directing it to be redder, darker, whiter, more saturated etc. Thus, a language and syntax can be provided for enabling simplification of the description of color effects, so that voice commands can be used to create a wide variety of such effects in a room or on an object.

Other commands can allow change until a 'stop' is reach or the color reaches a limit. For example, "House Room Darken" could begin to dim the lights until the command "Stop" is heard. If no command is heard the dimming would continue until the light turns off or reaches some limiting value.

As used herein, the term "LED" should be understood to include light emitting diodes of all types, light emitting polymers, semiconductor dies that produce light in response to current, organic LEDs, electro-luminescent strips, and other such systems. "LED" may refer to a single light emitting diode having multiple semiconductor dies that are individually controlled. It should also be understood that the term "LED" does not restrict the package type of the LED. The term "LED" includes packaged LEDs, non-

packaged LEDs, surface mount LEDs, chip on board LEDs and LEDs of all other configurations. The term “LED” also includes LEDs packaged or associated with material (e.g. a phosphor) wherein the material may convert energy from the LED to a different wavelength.

While the invention has been disclosed in connection with the preferred embodiments shown and described in detail, various modifications and improvements thereon will become readily apparent to those skilled in the art. Accordingly, the spirit and scope of the present invention is to be limited only by the following claims and their equivalents.